DOCUMENT RESUME

ED 068 488 TM 001 824

AUTHOR	Ramsey, Craig; Wright, E. N.
TITLE	The Raven Progressive Matrices: A Review of Literature Relating to Its Selection for Use in the New Canadian Study.
INSTITUTION	Toronto Board of Education (Ontario). Research Dept.
PUB DATE	Dec 68
NOTE	39p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Ability; Achievement Tests; Aptitude Tests; Cross Cultural Studies; Educational Research; Elementary Grades; Intelligence Tests; Literature Reviews; Norms; Secondary Grades; Test Construction; Testing; Test Interpretation; *Test Reviews; *Test Selection; Test Validity

ABSTRACT

Part of the New Canadian Study required the examination of general ability measures. The requisites were that the measure selected be applicable for Grades 5 to 9 and that it could be administered to students with a limited command of English. Included in this report are: (1) a summary of the considerations involved in selecting a general intellectual ability measure, (2) a review of testing, (3) reasons for selecting Raven's Progressive Matrices (PM), (4) an outline of the major features of PM, (5) a brief review of its previous use in sub- and cross-cultural studies, and (6) a description of the testing procedures used in the New Canadian Study. It is thought that these data will be useful if the PM is used in the school system after norms become available. (Author/JS)

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THE RAVEN PROGRESSIVE MATRICES: A REVIEW OF LITERATURE RELATING TO ITS SELECTION FOR USE IN THE NEW CANADIAN STUDY

Craig Ramsey

E. N. Wright

December, 1968

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THE RAVEN PROGRESSIVE MATRICES: A REVIEW OF LITERATURE RELATING TO ITS SELECTION FOR USE IN THE NEW CANADIAN STUDY

INTRODUCTION

Part of the New Canadian Study, carried out in response to the Board's request, required decisions concerning the use of some measures of general ability. These had to be applicable for Grades 5 to 9 and capable of being administered to students with a limited command of English.

This report summarizes the considerations involved in selecting a measure of general intellectual ability.

Following a brief review of testing, reasons for choosing the Raven's Progressive Matrices are given. The major features of this test are outlined and a brief review of its previous use in sub-cultural and cross-cultural studies is included. The report concludes with a description of the testing procedures used in the New Canadian Study. This material will be useful if the Progressive Matrices are used in the school system after norms become available.

The testing of human abilities is as old, at least, as formal teaching or education. Members of early or primitive societies compared such abilities as weapon proficiency and hunting skill. Currently, testing and assessing of people, particularly students is wide-spread. Basically the function of testing may be considered to place people on a scale with regard to a particular skill or ability.

Ability is defined as the "actual power to perform an act, physical or mental, whether or not attained by training or education," (English & English, 1957). Often the basis for comparing the individuals depends on assigning to each individual by use of a "test," a number which locates them on some form of scale.

The number of seconds required to complete a single mathematical exercise is one example of a test; the number of arithmetic questions correctly completed in a set time period is another kind of test.

Cronbach (1960) has defined a test as a "systematic procedure for comparing the behaviour of two or more persons," (p. 21). To make test scores comparable administration procedures are standardized. In an objective test the scoring procedure is also predetermined.

Interviews and clinical tests represent subjective observations and evaluations and may lead to varied procedures and lack of agreement between judges or "interpreters."

Ability Tests

Ability tests are usually classified as aptitude tests, achievement tests and intelligence tests to indicate the purpose of the test. An aptitude test is intended to measure what an individual can learn or achieve while an intelligence test is usually taken as a general measure of past experience, present performance as well as of future performance. An achievement test is intended to measure what an individual has learned. The classification of a test usually depends on its intended purpose. It is of course, an error to assume that assigning numerical values makes it possible to label precisely an individual with regard to an ability.

Characteristics such as personality, intelligence and perception are complex sums of hereditary factors, learning experiences, and their interactions. These characteristics change over time. Each response which an individual makes to a test is based on this complex of prior learnings. Because of this complex background an identical response from two individuals will not necessarily represent the same learnings.

Tests of ability, whether they are labelled aptitude, intelligence or achievement, all measure parts of what an individual has learned. The labelling of the test usually comes about through the purpose or aim of the test. It is possible to use the same question to suit all three purposes by carrying out different procedures with the test results. (See Cronbach and Meehl, 1955.)

Regardless of the test's use or purpose it is only partially possible to assess the person as he is today, a product of his past learnings.

Test theory, construction, usage and interpretations, with emphasis on educational usage, have been reviewed or summarized by several authors such as Vernon (1961) and Cronbach and Meehl (1955).

TESTING INTELLECTUAL ABILITY

The measurement of intellectual ability or "intelligence" may be described as the success story of clinical and educational psychology, and test publishers. This success stems from the widespread acceptance and use of various intelligence tests in education, vocational guidance, clinical evaluation and various industrial-personnel areas.

Though intelligence tests have been popular, the concepts of "intelligence," which the tests represent, have been widely criticized. These criticisms are directed mainly at the lack of validity for intelligence as an explanatory concept.

Perhaps the primary criticism is that of definition, or the lack of a comprehensive definition. The existing definitions range from those which consider intelligence as an intervening variable[1] to those which call it a hypothetical construct.[2] Spiker and McCandless (1954) for example, say that intelligence is what a given intelligence test measures in a specific situation, while Liverant (1960) uses intelligence as a "hypothetical construct whose validity depends on the verification or refutation of predictions derived from the theory which contains it," (p. 102). When laymen talk of intelligent behaviour they include many activities omitted by intelligence tests. In trying to develop a useful theory of intelligence,

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1 As an intervening variable, intelligence would be a general term representing a specific variable (scores on a test) that can be used only to show relationships.

2 As a hypothetical construct, intelligence would be conceived as a process that actually exists and produces measureable phenomena. These phenomena (e.g., test scores) can be used to explain and predict other behaviour. Only the hypothetical construct allows us to say "Because he is intelligent..."

theorists must cope with several major problems:

1. One problem is to account for genetic factors. Genetic theories suggest that each individual at conception inherits an unmodifiable growth process determined by the genes which set limits outside of which, environmental influences can make no differences in intellectual capacity. Hunt (1961) has assembled an array of experimental evidence against these ideas of a fixed, immutable intelligence. His argument is that experiences and interactions of specific experiences play a central role in the development of patterns of cognitive ability. He directs attention to the nature of learning and consequent change in abilities.

2. A second problem relates to the question of "constancy" of intelligence.

Bayley (1955) has demonstrated a lack of constancy in I.Q. Test scores over various childhood periods and Sontag, Baker and Nelson (1958) found that over 60% of the children in this study changed more than 15 I.Q. Test points in either direction sometime during the period of three to ten years of age. They also found that the direction and degree of change in the rate of intellectual development were related to personality dimensions and especially the need for achievement.

3. A third problem is the specification of behavioural referrants; that is, specifying the tasks (or test items) to be used for a test of intellectual ability.

Liverant (1960) has cited defects in the arguments and assumptions of general intelligence largely based on the unrelatedness of the test items to the theories. He also notes the influence of cultural values in deciding what is or is not intelligent behaviour.

4. A fourth problem stems from a partial failure of the theorists and practitioners to specify systematically the effect of situational or non-intellective variables such as anxiety and test sophistication. These variables are "social" or "cultural" factors which can distort an individual's score (see Riessman's (1962) study of culturally deprived children).

The development of tests which sample largely from the verbal domain has been widely encouraged, as verbal abilities seemed to predict school success best. This is hardly surprising as the educational process (formal education) is heavily dependent on language ability.[3] It is fairly obvious that the primary symbol system in western society is verbal. Verbal items have provided quick and efficient predictors for schools. Thus, the employment of verbal criteria to assess various abilities in educational areas has stemmed largely from expedience.

Applying tests that are verbally loaded to individuals who are learning English as a second language only compounds the problems of adequate assessment.

To measure fully intellectual ability would require sampling from every classifiable domain (including all verbal areas) in which learning has occurred. This would be an impossible task. For an individual with a limited knowledge of English, developing a measure of intellectual ability that taps all areas is even more difficult.

Attempts have been made to assess intellectual ability without penalizing any lack of verbal understanding by using carefully selected non-verbal tasks. These tests have been labelled as culture-free and culture-fair. Both terms are neither adequate nor accurate. Wesman (1968) has questioned

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[3] The work of Furth with the deaf (1964) presents new evidence that "intelligence" and "problem-solving" and "thought" are not dependent on overt or covert language (or speech).

the prevailing assumptions involved in testing, especially those concerning culture-free and culture-fair tests:

> "The notion of relevance of previous learnings leads naturally to a consideration of some follies we have committed in the search for culture-free or culture-fair instruments. I do not wish to impugn the high social motives which stimulate the search for such devices; I do wish to question that such a search, in its usual setting, is sensible. A culture-free test would presumably probe learnings which had not been affected by environment; this is sheer nonsense. A culture-fair test attempts to select those learnings which are common to many cultures. In the search for experiences which are common to several different cultures or subcultures, the vital matter of relevance of the learning for our purpose is subordinated or ignored."
>
> ...Wesman, 1968, p. 269

It was decided that the test of general intellectual "ability" for the New Canadian study must require a minimum of verbal involvement by the student. This meant that only certain kinds of learnings would be used. Also, it meant ignoring those "non-verbal" tests that required extensive verbal explanations or directions.

Theories of Intelligence

Among the current theories of intelligence and their measurement it was Cattell's approach that aided most in choosing a specific test. Cattell (1968, a, b, c) has proposed (following several decades of study) that general intelligence may be viewed as composed of two major components.

He calls the first major component "crystallized general ability" (g_c) which he says is shown in, "judgemental skills that have been acquired by cultural experience: vocabulary, good use of synonyms, numerical skills, mechanical knowledge, a well stocked memory, and even habits of logical reasoning." Cattell suggests that (g_c) is highly related to "subtests that

traditionally have been built into intelligence tests: vocabulary size, analogies and classification involving cultural knowledge of objects in the problem."

The second component group Cattell calls "fluid ability" (g_f) and proposes that it has "little relation to a well stocked memory. They are culture-fair perceptual and performance abilities...They involve solutions to tests of classifications, analogies (NOT verbal), matrices, topologies, and problems that do not involve much educational acquisition." He suggests that fluid ability may have some role in numerical reasoning, or even in some verbal skills; it is also a component of spatial reasoning and is very powerful in inductive reasoning.

Cattell has found fluid ability and crystallized ability to be closely related but he also gives examples of individuals who display one ability more prominently than the other. He also finds that when independently measured, the age-curves of growth for these two major abilities are different. While the fluid intelligence reaches its peak in the "teens" and declines steadily thereafter, the crystallized intelligence peaks later (age 20 - 30) and maintains its level through, and even past middle age. Anastasi (1958) has also documented this difference of age-curves in comparing performance and non-language tests to verbal tests.

Concerning these different age-curves, Cattell (1968, a) said that "the puzzling phenomena in intelligence testing are explained if we consider that the traditional intelligence test actually is a mixture of fluid and crystallized factors." He suggests that the impact of (g_c) is greater in terms of generating individual differences in learning at early ages than at later ages. These findings led Cattell to develop what he called a Culture-Fair Test based on the concept of fluid ability. He finds no

significant gains in test scores as a result of retesting (practise effects or test sophistication) unlike findings with traditional intelligence tests which have many verbal and numerical items.

Deal and Wood (1968) refer to Cattell's work and theory as "most provocative research," and suggest that interactions in early years between intellectual factors and environment contribute to personality differences as well as patterns of cognitive differences.

Cattell's work, in part, receives support from another prominent theorist, J. P. Guilford. Guilford (1968) also notes that the content of the traditional intelligence test "weights heavily those intellectual abilities that are pertinent to school learning in the key subjects of reading, and arithmetic, and other subjects that depend directly upon them or are of similar nature psychologically." Like Cattell, he also notes that intelligence tests and academic aptitude tests are poorer predictors at educational levels higher than the elementary grades.

Although Cattell has developed a specific culture-fair test based on his reasoning, unfortunately, it requires considerable verbal instructions. In 1965, the Research Department prepared a critical technical review of this test (available if requested). Cattell's test was not chosen for the New Canadian Study.[4] The Raven Progressive Matrices seemed like a suitable alternative. Like Cattell's test, it consisted of items not directly dependent on "school learning," furthermore it has received more favourable critical review and has been extensively used and documented with many cultures. The ages of students to be tested furthermore covered the range with which the 1938 Raven Progressive Matrices has been shown to be most effective and discriminating.

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[4] The necessary verbal instructions and the limited use which this test has enjoyed made it a second choice.

THE PROGRESSIVE MATRICES TEST

The Progressive Matrices Test (1938) or "Standard Progressive Matrices" was published in 1938 by J. C. Raven. It was designed to measure the ability to perceive relationships which Raven assumed was the basic indicator of general intelligence. The rationale and construction of the test stemmed from Spearman's theory of mental organization in which all intellectual activities (or cognitive abilities) have in common a general or (g) factor as well as specific or (s) factors (one for each specific ability) and also group factors which overlap clusters of specific abilities, (see Anastasi, 1958, Chapter 10).

Unlike most American tests which use a series of empirically chosen, heterogeneous items, the Progressive Matrices uses homogeneous items which require the perception of spatial relations.[5]

The Progressive Matrices (1938) consists of 60 separate problems (arranged in five Sets) each in the form of a two-dimensional matrix or geometrical design in which some part (or section) has been omitted. The testee must choose the missing portion from the choices provided below each matrix. Only one choice is permitted for each problem.

Twelve problems complete a Set and there are five Sets labelled A to E. The problems are arranged in order of increasing difficulty within each Set so that the relatively easy solution to the first item helps to show the subject the way in which the more difficult problems are to be answered.

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[5] A test that is highly selective or "homogeneous" in its content may be referred to as having "low-bandwith" and "high-fidelity." Such tests are found to be excellent predictors, (Cronbach, 1960, p.602).

The first item in each Set is reproduced at the end of this report. The "themes" or strategies of the five Sets are of:

A) continuous patterns;

B) analogies between pairs of figures;

C) progressive alterations of figures;

D) permutations of figures, and

E) resolution of figures into constituent parts.

"The directions are very simple, so that verbal understanding plays little part. Indeed, with very easy initial items, the test can be administered in pantomime so that the verbal element is entirely eliminated." (Cronbach, 1960, p. 215).

Additional Versions

The Coloured Progressive Matrices (1947) and the Advanced Progressive Matrices (1947) are alternate versions of the 1938 test. The "Coloured" edition is made up of Sets A and B of the 1938 test plus Set Ab of intermediate difficulty. The items are printed in several colours. It was designed to allow for a wider range of scores for children in the 5 to 11 age group and for use with groups considered intellectually impaired or subnormal.

The Advanced form was developed for use with adults of above average intellectual ability because the Progressive Matrices failed to discriminate accurately among these individuals (Foulds and Raven, 1950). Yates (1961) found that the Advanced Progressive Matrices corrects this deficit and provides a wider distribution of scores for the above average group. As only the Progressive Matrices were used in the New Canadian Study it will be referred to as the P.M. (1938).

Studies and Reviews of the Progressive Matrices

After the early standardization studies the first widespread use of the P.M. (1938) occurred when it was adopted in Great Britain during World War II for use in military classification. Its choice was due to the fact that as a non-verbal measure of intellectual ability, military recruits would not be as likely to be rejected or penalized because of poor or limited education. However, because of its "homogeneous" nature, specialized tests containing measures of numerical, verbal and other general abilities proved better predictors of performance in the various training areas. The Matrices Test was still used as a "general" measure of intelligence and in predicting performance in some specialized areas such as radar operating (Vernon and Parry, 1949).

In commenting on the P.M. (1938), Cronbach (1960) has noted that this "non-verbal score, however, has one special function in school testing. It calls attention to pupils who have good reasoning ability but who are below standard in reading and verbal development. Such cases are obscured by a test that mixes verbal and non-verbal components together..." (p. 217).

The P.M. (1938) has been used in many studies and its quality, as a test has also been studied. Raven's Guide to the Progressive Matrices (1965 edition) lists approximately 200 references from 1938 to 1963 and Buros' (1965) Sixth Mental Measurements Yearbook lists 193 references for the Progressive Matrices.

The single most detailed study of the Progressive Matrices is a review and evaluation by Burke (1958) who uses 144 references to discuss the test's history, use and validity. This major study helped in deciding to use the P.M. (1938) and in locating much of the research cited in this paper.

In reviewing studies of validity, Burke (1958) found that correlations between the P.M. (1938) and non-verbal tests of mental ability are higher than correlations between the P.M. (1938) and verbal tests of mental ability. For example, Hall (1957), working with adults found a correlation of .70 between an abbreviated P.M. (1938) and the Wechsler Performance Scale of Intelligence and one of .58 with the Wechsler Verbal Scale of Intelligence. Barratt (1956) compared the P.M. (1938) with the Columbia Mental Maturity Scale (C.M.M.S.) and the Wechsler Intelligence Scale for Children (W.I.S.C.) on a sample of children. He found the P.M. (1938) correlated higher with the W.I.S.C. (which has a Performance section) than the C.M.M.S. and suggested that where time was limited or where the subject had handicaps which made the W.I.S.C. unsuitable, the P.M. (1938) was a better alternative than the C.M.M.S.

The consistently high reliability of the P.M. (1938) has been extensively documented. Raven (1948) has found that reliability is better for high scoring than low scoring persons. Test-retest reliability coefficients are available for many large groups including civil servants of various age ranges, young adults, hospitalized neurotics, children and Belgian army recruits:

-- for civil servants in the over-50 age group $r = .83$ and in the under-30 age groups $r = .93$ (Foulds & Raven, 1948);

-- for young adults, reported reliabilities range from .79 (Eysenck, 1944) to .93 (Foulds, 1948);

-- for hospitalized neurotics and a matched group of normal adults $r = .809$ and $r = .872$ respectively (Eysenck, 1944);

-- for children, reported reliabilities range from .71 (Moore & Peel, 1951) to .88 (Raven, 1939);

-- for Belgian army recruits both French and Flemish speaking, reliabilities were greater than .85 (Delys, 1953 reported in Burke, 1958).

The lower reliabilities are generally reported for groups such as hospitalized psychiatric cases, organically impaired (e.g., epileptics) and

for young children (under 10), (Desai (1952), Eysenck (1952), Hall (1957) and MacLeod and Rubin (1962).) Nonetheless the reliability is adequate to permit the use of the test diagnostically in a clinical situation (Knehr, 1962).

The P.M. (1938) has also been used for predicting academic success, and was "...surprisingly useful in predicting success for students in architecture." (Harding, 1943). It was also used by Orton & Martin (1948) in screening medical students, and Moore & Peel (1951) used it in predicting aptitude for dentistry. Burke (1958) notes: "There is abundant evidence of concurrent validity for the P.M. (1938), in the sense of its capacity to discriminate over a wide range among groups known by other criteria to differ in intellectual ability." (p. 210).

There is, not surprisingly, no complete agreement as to exactly what the P.M. (1938) measures. Burke (1958) states that there is no convincing evidence that it is a valid measure of Spearman's construct (g) (if such a construct can be measured). Nonetheless, the P.M. (1938) is "a useful research tool, especially in the growth and deterioration of mental efficiency. It has especial value for use with special groups..." (Burke, 1958, p. 222).

The most recent Canadian study involving use of the P.M. (1938) is that of MacArthur (1968) which became available after the data collection phase of the New Canadian Study. MacArthur using groups of northern Indian, Metis, White and Eskimo children, studied the validity of several "culture-reduced" measures of intellectual ability as indicators of potential integration of these native groups into larger communities. The P.M. (1938) was found to be one of the few tests closely approaching MacArthur's criteria for measures of intellectual potential with minimum cultural bias.

Authors such as Sperrazzo & Wilkins (1958) and Green & Ewert (1955) have suggested that norms established by Raven (1947) in Great Britain should be used "cautiously" with non-British groups. They also suggest that the

ceiling of the tests (P.M. (1938) and Coloured Progressive Matrices (1947)) may be too low for the above-average individuals in the age ranges advised by Raven.

Burke (1958) also noted that no one study has yet provided both comprehensive age norms and correlations with other measures. This shortcoming will be at least partially overcome in the New Canadian Study where over 5,000 students (Grades 5, 7 and 9) were tested with the P.M. (1938) and other measures of language competence, vocabulary and mathematical ability.

THE PROGRESSIVE MATRICES IN CROSS-CULTURAL AND SUB-CULTURAL STUDIES

Research on cross-cultural and sub-cultural differences in test performance cannot be reviewed adequately in a short article.[6] A representative selection of studies using the P.M. (1938) or its modifications are presented below. These illustrate the test's use and further document its appropriateness.

The P.M. (1938) in cross-cultural and sub-cultural studies is generally used either to compare intellectual ability or to control for it in a more elaborate study. Torrance (1968) has reviewed the testing of educational and psychological development of students in other cultures and sub-cultures and has noted that: "the favourite instruments for assessing intellectual abilities have continued to be the various modifications of the Goodenough Draw-A-Man Test and the Raven Progressive Matrices."(p. 71). Vernon (1967) studied the use of a non-verbal battery of "intelligence" tests under differing conditions of administration and amounts of coaching. The study, carried out with East African students was not designed to test reliability or validity of the measures used. The authors chose measures of expected usefulness and the P.M. (1938) was one of the three non-verbal measures in their battery.

The second use of the P.M. (1938) is to act as a form of "control measure" (Torrance & Johnson, 1966 & Johnson & Anderson, 1964). Essentially, such research studies are designed to examine some variable such as mathematical performance or occupational success while controlling for "intelligence." Some illustrations follow.

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6 For a more detailed summary of cultural differences see Anastasi (1958).

Sperrazzo & Wilkins (1959) used the P.M. (1938) in a comparison of Negro and Caucasian adult groups; they could not equate thir samples on socio-economic levels as the American Negro class structure was not directly comparable to that of American White and there were consequently "race differences" in "intelligence" test scores. Of most interest was the finding that a "relatively nonverbal performance test is demonstrably sensitive to differences in socio-economic level" within each racial (or cultural) group (see Sperrazzo & Wilkins, 1958).

Dockrell, (1966) studied the relationships between patterns of abilities and two variables, socio-economic status (lower and middle) and type of secondary education (public and technical). The P.M. (1938) was used as part of a battery to show changes in the patterns of abilities of the two class levels in the different school programmes.

Delys (1953 noted in Burke, 1958) used the P.M. (1938) so that he could discriminate between Belgian military recruits, (a) from different language and socio-economic backgrounds and (b) from different educational levels.

MacArthur & Elley (1963) carried out a large study investigating the extent of socio-economic bias in selected intelligence tests. Their aim was to identify and construct tests and batteries which might better estimate the intellectual potential of students from deprived cultural educational backgrounds. They administered nine "culture-reduced" tests and sub-tests to a large sample of 12 and 13 year old children and analyzed their results in relation to measures of socio-economic status, verbal intelligence, achievement and school marks. Their results showed it was possible to measure a broad component of intellectual ability with significantly

less cultural bias than is found in conventional intelligence tests. The Raven Progressive Matrices proved the most useful test in the battery showing a high "g" loading (indicating some "homogeneous" factor in mental ability); a consistent and minimal relation with socio-economic status; no evidence of cultural bias by items and moderate correlation to school success. The minimal relation to socio-economic status is not clearly opposed to the Sperrazzo & Wilkins (1959) findings of socio-economic difference as MacArthur & Elley used a more restricted or limited group, i.e. students from one grade level.

Burgin and Edson (1967) used the Coloured Progressive Matrices (because of the low age range) and the Goodenough Draw-A-Man Test in assessing newly arrived, young, immigrant children. Their findings suggested that a test such as the Goodenough was inaccurate for assessing the newly arrived child as the scores increased significantly as the children became more integrated. The Coloured Progressive Matrices, while indicating lower "intelligence," correlated much better than the Goodenough with teacher ratings of educational ability and did not show increased scores on retesting. Houghton (1966), in a study comparing five-year-old West Indian immigrants and English children, also found no significant change in scores of Coloured Progressive Matrices on retesting.

In reviewing the area of cultural differences, Anastasi (1958) has noted that the differences in psychological traits tend to be individual and that differences between cultural groups are found in patterns of abilities. It is necessary to repeat that the greatest limitation in any cross-cultural study has to do with the process of testing itself. While, people do evaluate each other, the highly formalized standardized testing situation of North

America (separate answer sheets, clock, multiple choice questions and often novel material) is, however, a strange irrelevant procedure in the perception of some students from other cultures.

CONCLUSION

For reasons outlined, the P.M. (1938) was chosen to provide a measure of intellectual ability of students involved in the New Canadian Study.

In the Study, the P.M. (1938) was administered to class groups with the test-time period set at 30 minutes. This time limit was established for several reasons. First, there is some relationship between speed and problem-solving ability. Eysenck (1953, 1967) and Furneaux (1960) have argued that the speed with which an individual produces hypotheses is the essence of good problem solving and, therefore, a speeded test is the best indicator of cognitive or intellectual ability.

Second, part of the sample used in the New Canadian Study was in Grade 9 and a half-hour test plus distribution of materials and directions could be fitted into one regular class period. This time limit would help to ensure standard conditions of administration and also offset possible test fatigue. Third, since the educational process is marked by set time factors in class periods and examination periods, it was assumed that a group test given in a classroom by a familiar staff member would produce less interference and arouse less anxiety than if given by an individual administrator without a time limit.

Teachers or Guidance Department Staff who administered the test were provided with a procedure for administration (see Appendix I). Each student in the group received a test booklet and an answer sheet (see Appendix II). Their answers were marked on a specially prepared Digitek score sheet, prenumbered to indentify it for later scoring and analyses.

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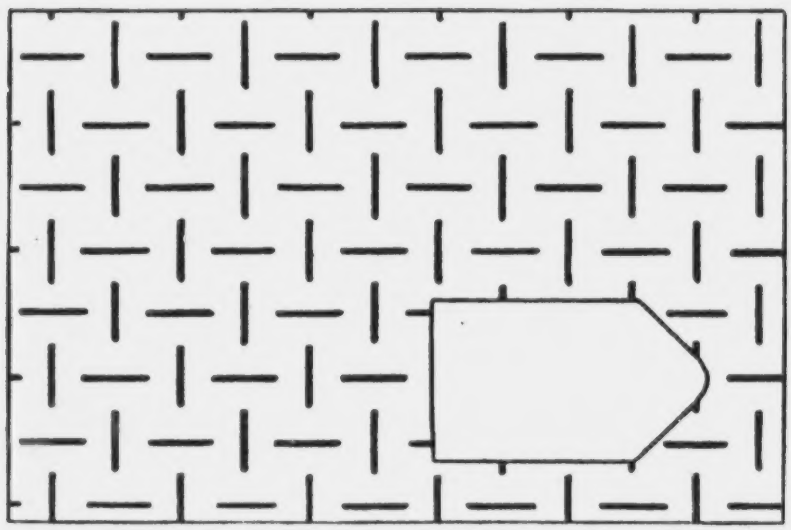
APPENDIX I

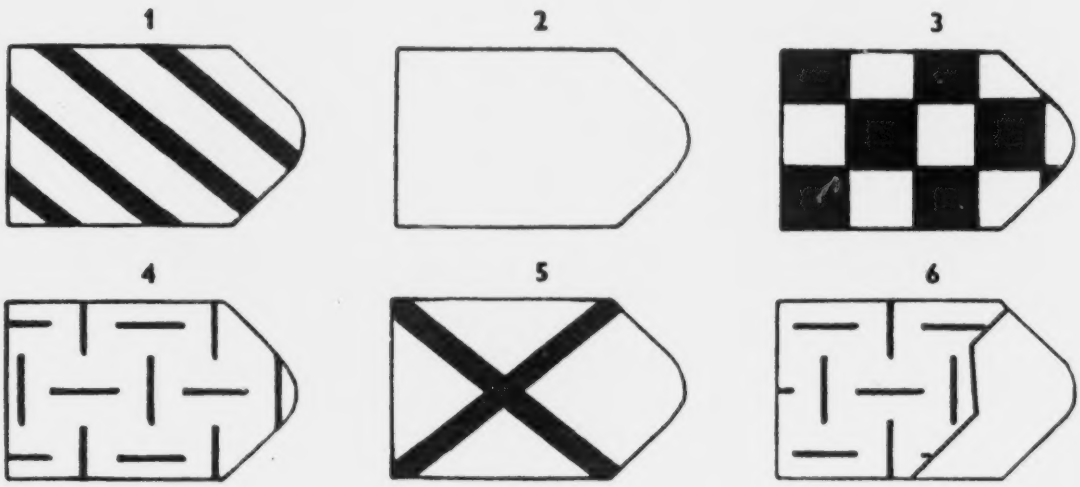
THE FIVE BASIC PROBLEMS OF THE PROGRESSIVE MATRICES:
EACH IS THE FIRST PROBLEM OF THEIR RESPECTIVE SETS

PROBLEM A1

SET A

A I

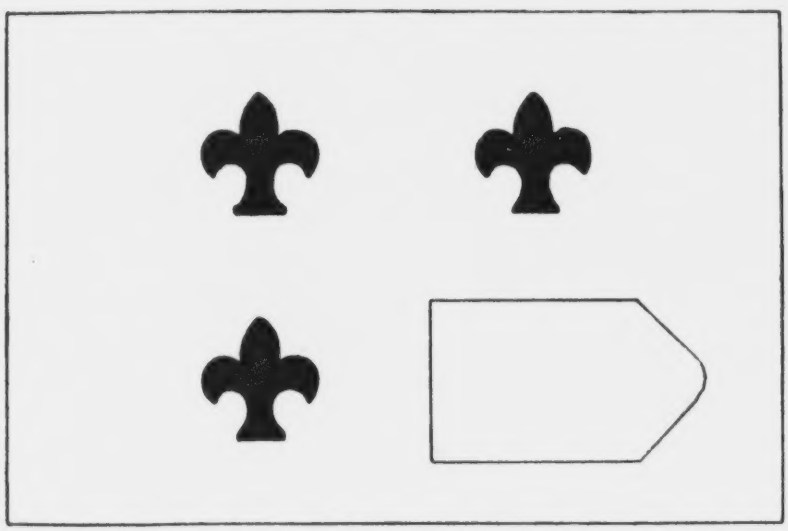


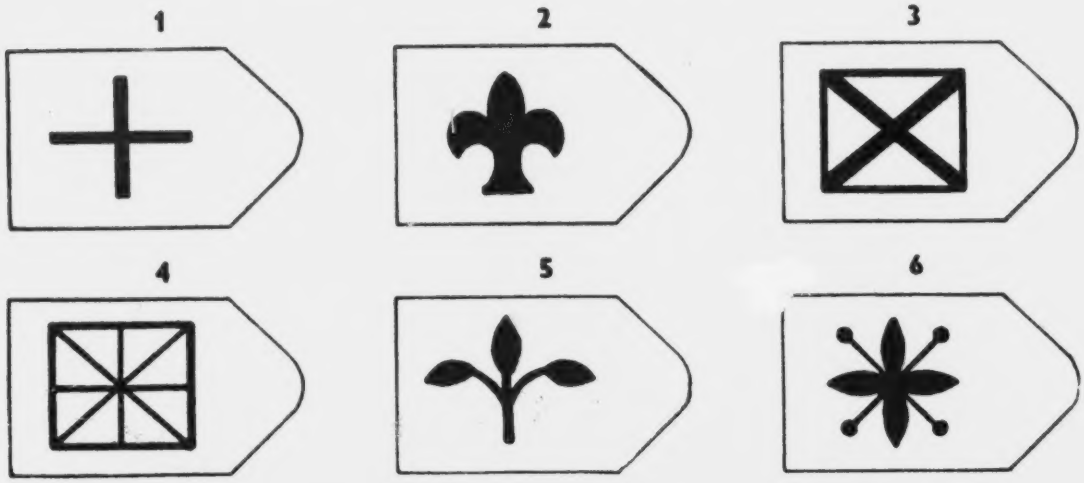


PROBLEM B1

SET B

B 1

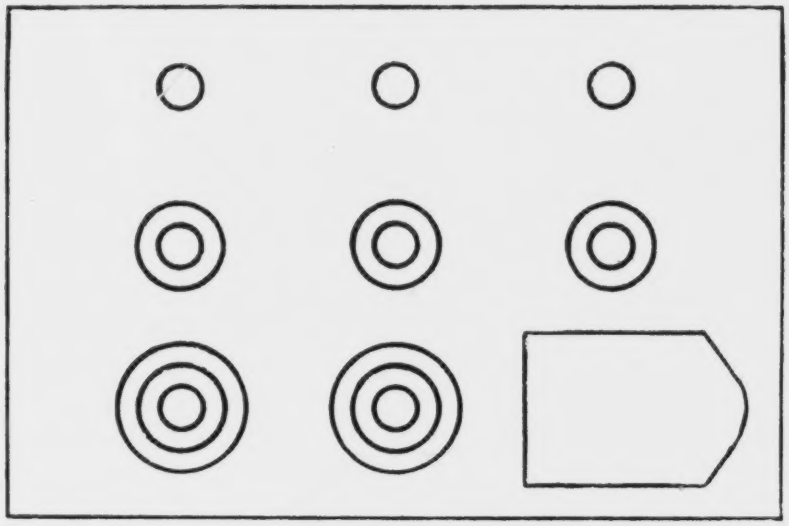


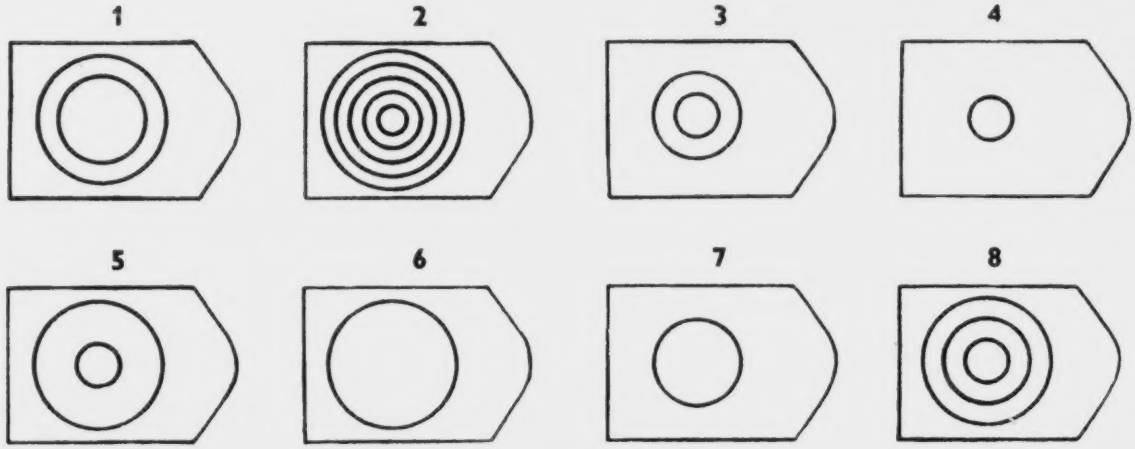


PROBLEM C1

SET C

C I

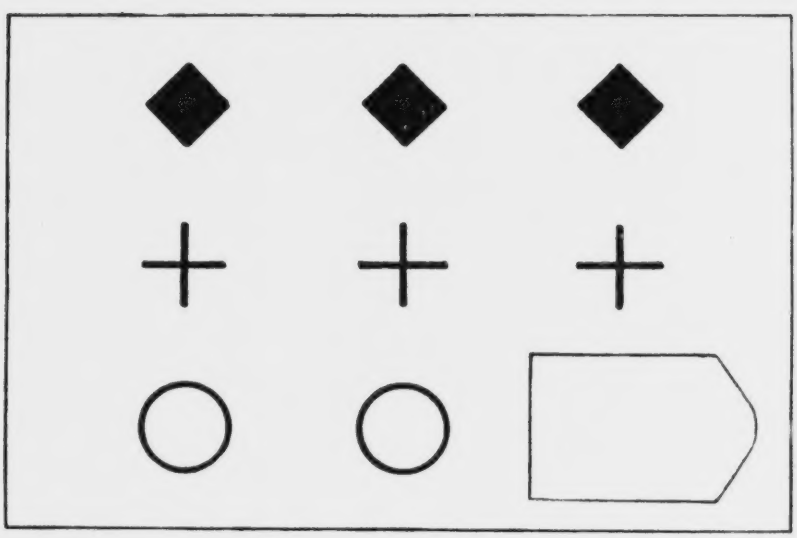


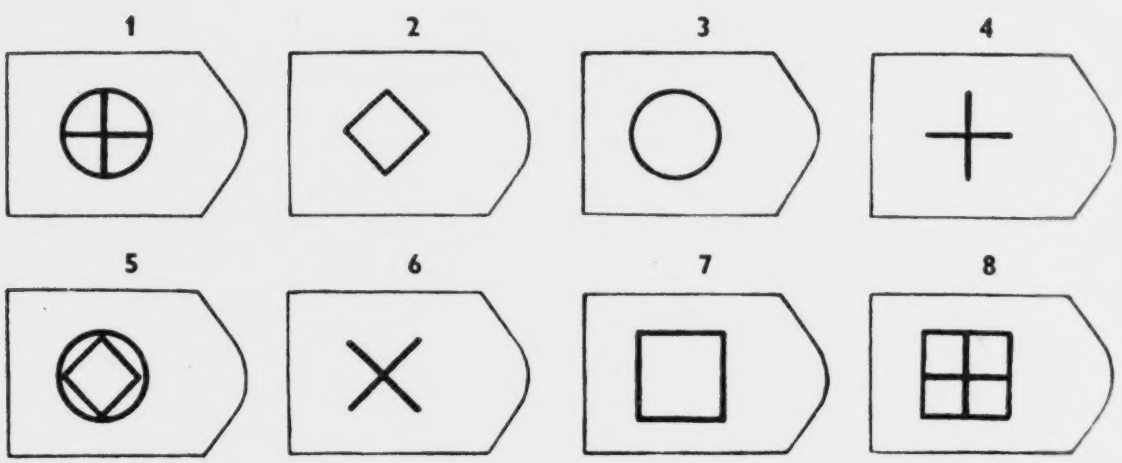


PROBLEM D1

SET D

D 1

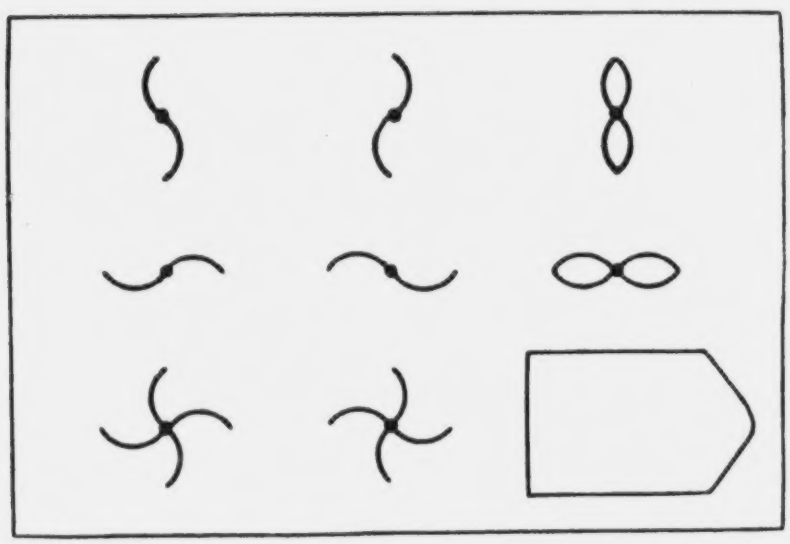


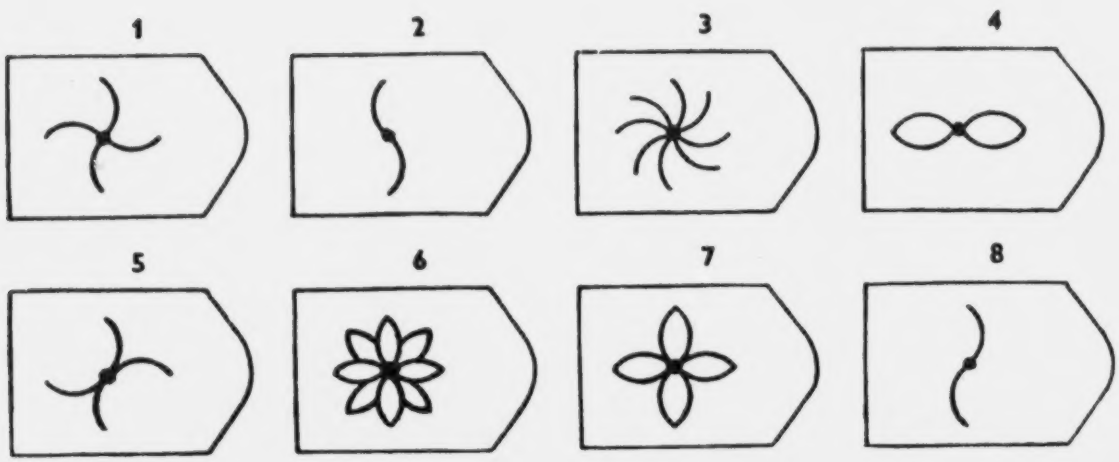


PROBLEM E1

SET E

E 1





APPENDIX II

TEACHER GUIDE FOR PROGRESSIVE MATRICES

The Matrices "test" (or instrument) consists of 60 items. On each page the student will find a pattern or set of objects in the top half and a set of choices on the bottom half.

The task for the student is to choose the piece (they are numbered) which he thinks will complete the pattern at the top. The student must mark his choice on the digitek answer sheet.

NOTE: Some students will not be able to complete all the items in 30 minutes, especially the elementary students. This is expected and acceptable.

1. Distribute Answer Sheets

   (a) Make sure students get the answer sheet with their specific number -- as determined by the questionnaire from the previous week.

   (b) Have students transfer their number down on the grids.

   (c) Have students print their name on the answer sheets.

   (d) Dictate the School Number, and have the student print it in the space provided and transfer it to the grid. (A list of school numbers was attached to the questionnaire instructions.)

   (e) Tell students that this answer sheet is to be completed as was the questionnaire, using pencils. (See general instructions which accompanied the questionnaires.) ALL students in class are to complete this instrument (if a student missed the questionnaire, assign the student an unused number) including those who have language problems. These students should not get extra coaching as the interest of the study is in the performance, under uniform conditions, of all students INCLUDING those with varied language backgrounds.

2. General Instructions

This text is only a suggested guide to be used at the discretion of the administrator, depending on grade level. It is intended to help the students understand the procedure. In other words, you may modify the explanation for the examples.

LOOK AT THE FIRST PAGE OF BOOKLETS I AM GOING TO DISTRUBTE.

Distribute the Matrices booklets.

LOOK AT PAGE A1. EVERY PAGE IN THE BOOKLET HAS SOME DESIGN OR PATTERN WITH A PIECE MISSING. YOUR JOB IS TO PICK ONE PIECE FROM THE BOTTOM OF THE PAGE TO COMPLETE THE PATTERN.

LOOK AT THE PATTERN IN A1 -- ONE PIECE COMPLETES THE PATTERN. WHICH PIECE FITS?

Ask for oral reply and explain if an incorrect answer is given.

MARK THE ANSWER SHEET THE SAME WAY AS THE EXAMPLE IS MARKED. MARK THE NUMBER 4 GRID.

Check to ensure that they understand the marking procedure.

TURN TO A2.

Pause.

WHAT IS THE CORRECT ANSWER? MARK IT IN THE GRID BESIDE A2.

Pause.

DID YOU MARK IT THE SAME WAY AS EXAMPLE A2?

(which is No. 5 grid)

If students make any errors, which you are aware of, in marking these first two items (A1 and A2) stress that they must <u>erase</u> the incorrect choice when making another choice.

Answers are to be marked;

ONLY ONE MARK FOR EACH QUESTION.

WHEN I TELL YOU TO BEGIN -- CONTINUE WITH A3 AND DO AS MANY AS YOU CAN IN ORDER -- DO ALL THE A'S THEN ALL THE B'S ETC.

TRY TO DO EACH QUESTION. GUESSING IS ALLOWED.

START NOW.

Allow 30 minutes then immediately collect the booklets and answer sheets for packaging.

APPENDIX III

Progressive Matrices

ONLY ONE MARK IN EACH ROW

EXAMPLE

A 1	1	2	3	■	5	6
A 2	1	2	3	4	■	6

STUDENT NUMBER: 00200

SCHOOL NUMBER

| | | | | | |